Species at Risk Act
Management Plan Series

Management Plan for the Dwarf Woolly-heads (*Psilocarphus brevissimus*) - Prairie Population - in Canada

Dwarf Woolly-heads

2018

Government of Canada
Gouvernement du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2018. Management Plan for the Dwarf Woolly-heads (*Psilocarphus brevissimus*), Prairie population, in Canada. *Species at Risk Act* Management Plan Series. Environment and Climate Change Canada, Ottawa. iv + 30 pp.

For copies of the management plan, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

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Également disponible en français sous le titre
« Plan de gestion du psilocarphe nain (*Psilocarphus brevissimus*), population des Prairies, au Canada »

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ISBN 978-0-660-26064-8
Catalogue no. En3-5/96-2018E-PDF

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[1] http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed species of special concern and are required to report on progress five years after the publication of the final document on the SAR Public Registry .

The Minister of Environment and Climate Change is the competent minister under SARA for the Dwarf Woolly-heads and has prepared this management plan as per section 65 of SARA. To the extent possible, it has been prepared in cooperation with: Department of National Defense, province of Saskatchewan, province of Alberta, as per section 66(1) of SARA.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this plan and will not be achieved by Environment and Climate Change Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Dwarf Woolly-heads (Prairie population) and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=En&n=6B319869-1%20

Acknowledgments

The management plan was prepared by Candace Neufeld (Environment and Climate Change Canada). An early draft was prepared by Sara Pieper (contractor) and Darcy Henderson (Environment and Climate Change Canada). Valuable reviews were also provided by Victoria Snable (Environment and Climate Change Canada). The Saskatchewan Conservation Data Centre and Alberta Conservation Information Management System provided updated element occurrences. The co-operation of all the landowners, lessees and land managers who granted access to their land to do surveys and who continue to provide habitat for species at risk is greatly appreciated.

Executive Summary

Dwarf Woolly-heads is a small, annual herb. Leaves and flower heads are densely woolly with the latter being fairly inconspicuous. Fruits are achenes that are free from barbs or hairs. The species is confined to the drying or drawdown edges of ephemeral wetlands.

The species' range is disjunct in Canada, resulting in a Southern Mountain Population in British Columbia and a Prairie Population in Alberta and Saskatchewan. This management plan deals only with the Prairie Population. There are 50 extant subpopulations in the Prairie Population with 4 in Saskatchewan and 46 in Alberta. A population estimate, based on the most recent surveys of each subpopulation, indicates over 50,000 Dwarf Woolly-head plants; this number fluctuates greatly from year to year. Dwarf Woolly-heads is listed as a species of special concern under the *Species at Risk Act* (SARA).

The most significant threat to Dwarf Woolly-heads on the prairies is continued habitat loss, fragmentation and/or degradation through the creation of roads, transmission lines, and pipelines. Other threats include annual and perennial non-timber crops (cultivation), oil and gas drilling, dams and water management (alteration to hydrology), invasive alien species, agriculture effluent (non-specific herbicide use), and droughts.

The management objective for the Prairie Population of Dwarf Woolly-heads is to maintain the currently known extant subpopulations of Dwarf Woolly-heads in Alberta and Saskatchewan, as well as any additional subpopulations newly located or rediscovered in the future.

Broad strategies to address the threats and attain the management objective include inventory and monitoring, research as part of an adaptive management framework, communication/collaboration/engagement, and habitat assessment/management/conservation. Conservation measures are described to address these broad strategies.

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1. COSEWIC* Species Assessment Information

Date of Assessment: April 2006

Common Name (population): Dwarf Woolly-heads (Prairie population)

Scientific Name: *Psilocarphus brevissimus*

COSEWIC Status: Special Concern

Reason for Designation: This population is widely distributed in Saskatchewan and Alberta at more than 40 sites with large among-year fluctuations in numbers of mature individuals and with concerns over potentially significant future impacts. These pertain to potential future development of coal-bed methane gas extraction in a significant part of the range of the population and disruptions from pipeline construction.

Canadian Occurrence: AB, SK

COSEWIC Status History: Designated Special Concern in April 2006.

*COSEWIC – Committee on the Status of Endangered Wildlife in Canada

2. Species Status Information

In Canada, Dwarf Woolly-heads is listed as special concern under Schedule 1 of the *Species at Risk Act* (SARA). The conservation status of Dwarf Woolly-heads throughout its range in North America is described in Table 1. It is estimated that Canada holds less than 5% of the species' global range, although this is difficult to estimate because the species abundance is not tracked in many states in the U.S (Table 1).

Table 1. Conservation status of Dwarf Woolly-heads (NatureServe 2015b).

Global (G) Rank[a]	National (N) Rank[a]	Sub-national (S) Rank[a]
G4T4?	Canada: N2N3	Canada[b]: Saskatchewan (S1S2), Alberta (S2S3), British Columbia (S1)
	United States: NNR	United States: California (SNR), Idaho (S2), Montana (S1), Nevada (SNR), Oregon (SNR), Utah (SNR), Washington (SNR), Wyoming (S2)

[a] Rank: 1– critically imperiled; 2– imperiled; 3- vulnerable to extirpation or extinction; 4- apparently secure; 5– secure; NR – status not ranked; ? – inexact or uncertain and qualifies the character immediately before it: the trinomial (T) rank after a species' global rank indicates the status of infraspecific taxa (subspecies or varieties).

[b] In Canada, Dwarf Woolly-heads is known from south-central British Columbia (Southern Mountain population), and from southeastern Alberta and southwestern Saskatchewan (Prairie population). The Southern Mountain population (BC) and the Prairie population (AB, SK) are separated by a distance of over 500 km and several mountain ranges, and are treated as different designatable units under COSEWIC and SARA (COSEWIC 2006). Only the Prairie population of Dwarf Woolly-heads is discussed in this management plan. Note that *Psilocarphus brevissimus* var. *brevissimus* is the only variety of the species in Canada, and it is referred to simply as *Psilocarphus brevissimus* in federal documents and databases.

3. Species Information

3.1. Species Description

Dwarf woolly-heads is a short annual herb with woolly leaves (Figure 1). Plants grow from 2-10 cm tall, often prostrate or matted and much-branched, and have a short taproot. Leaves are present only on the stem, are opposite, 5-15 mm long and approximately 1.5-5 mm wide; the upper leaves often surpass the flowering heads. Leaves are covered in whitish, woolly-hairs. Flower heads are spherical, 6-9 mm across, and are densely woolly. Flower heads are usually solitary and located in leaf axils or ends of the stems, and contain 8-80 female flowers and a few central male flowers (Figure 1). Unlike most members of the family Asteraceae, flowers of this species lack involucres (small bracts beneath the flowers), or ray petals. Female flowers are enclosed in woolly, sack-like receptacle bracts which are 2.5-4.0 mm long at maturity. These, like most structures on the plant, are densely woolly. Fruits are achenes that are 1-2 mm long, flat, free from barbs or hairs, and are tipped with a small, offset style (Douglas 1998; Kershaw et al. 2001; Morefield 2006).

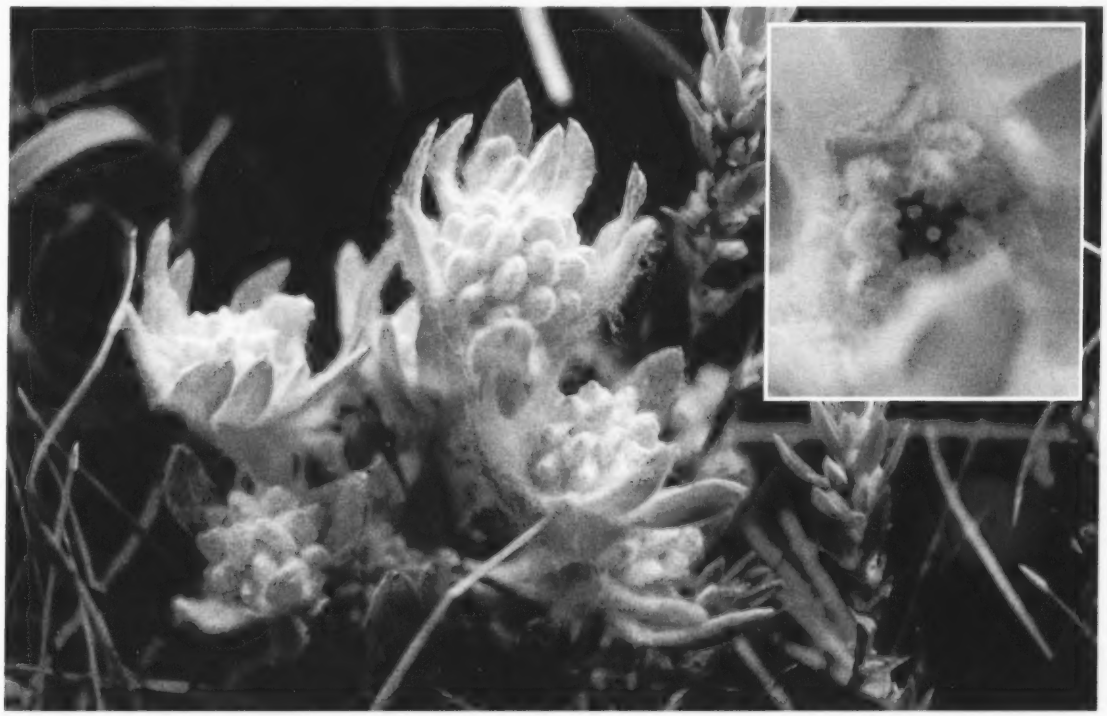

Figure 1. Dwarf Woolly-heads plant; inset shows male flowers and central photo shows female flowers © Saskatchewan Ministry of Environment, Photos: Sarah Vinge-Mazer.

3.2. Population and Distribution

There are two disjunct populations of this species in Canada recognized by COSEWIC as evolutionarily distinct "designatable units" due to their geographic separation: south central British Columbia (Southern Mountain Population) and southeast Alberta/ southwest Saskatchewan (Prairie Population) (COSEWIC 2006, Environment Canada 2013c). This management plan deals only with the Prairie Population. Globally, this species' range extends south to include the western USA from Montana south to Utah and west to California and Baja California, Mexico (Figure 2; Douglas 1998; Morefield 2006). Separate populations have also been found in Argentina and Chile (Cronquist 1955, Douglas 1998).

Figure 2. Current range of Dwarf Woolly-heads in North America.

Within the Prairie Population, as of 2014, there were 46 extant[3] subpopulations[4] and 7 historic[5] subpopulations (1 possibly extirpated[6]) known in Alberta, and 4 extant subpopulations known in Saskatchewan (Appendix A, Figure 3). These numbers differ from the most recent COSEWIC status report (2006), as they either have been discovered since publication of that status report, or the data for some of the subpopulations reported in COSEWIC (2006) in Saskatchewan are not available at this time (refer to footnotes in Appendix A).

The total population size for Dwarf Woolly-heads is difficult to determine in any given year. Population estimates based on the most recent surveys of each

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[3] *Extant means the occurrence has been recently verified as still existing, information on the location is accurate, and habitat still exists at the time of writing the management plan.*

[4] *Each subpopulation is geographically or otherwise distinct with little demographic or genetic exchange with another subpopulation (IUCN 2001). Each subpopulation is composed of one or more occurrences (a grouping of plants separated from another grouping of plants, either temporally or spatially; sometimes referred to as a patch, or source feature). For the purposes of the management plan, a subpopulation will be equivalent to an element occurrence, as defined by NatureServe (2015a).*

[5] *Historic means that the habitat still exists, or could exist with proper management, but presence of the species has not been reconfirmed at that occurrence for 20 or more years. In some cases, historic may also indicate an occurrence greater than 20 years old that also has inaccurate or vague locational information, making it difficult or impossible to confirm relocation (NatureServe 2015c).*

[6] *Extirpated either means that conditions or habitat no longer exist at an occurrence to support the species, or sufficient surveys have taken place at the occurrence over an adequate time period (over 20 years) and during good growing years, conducted by experienced surveyors, yet failed to relocate the species at the occurrence (NatureServe 2015c).*

subpopulation (from various years) indicate over 50,000 Dwarf Woolly-head plants (Appendix A). However, large fluctuations in population size have been noted for this plant, typical of an annual plant tied to annual precipitation patterns. Therefore, the plant's rates of germination, seed production and seedling establishment vary across years (COSEWIC 2006). The plant is also difficult to detect, adding to the difficulty of obtaining accurate population counts. In addition, estimates or counts were not taken at many of the subpopulations, nor have most subpopulations been revisited, monitored or had consistent methodology used in surveys. Due to these factors, comparisons of abundance between or among years are of limited use. For example, COSEWIC (2006) reported that the aggregate total population of Dwarf Woolly-heads in the Prairies may be between 9,000 and 27,000 in peak growing years and between 2,000 and 5,000 in years with poor growing conditions. Population trends for this species are unknown.

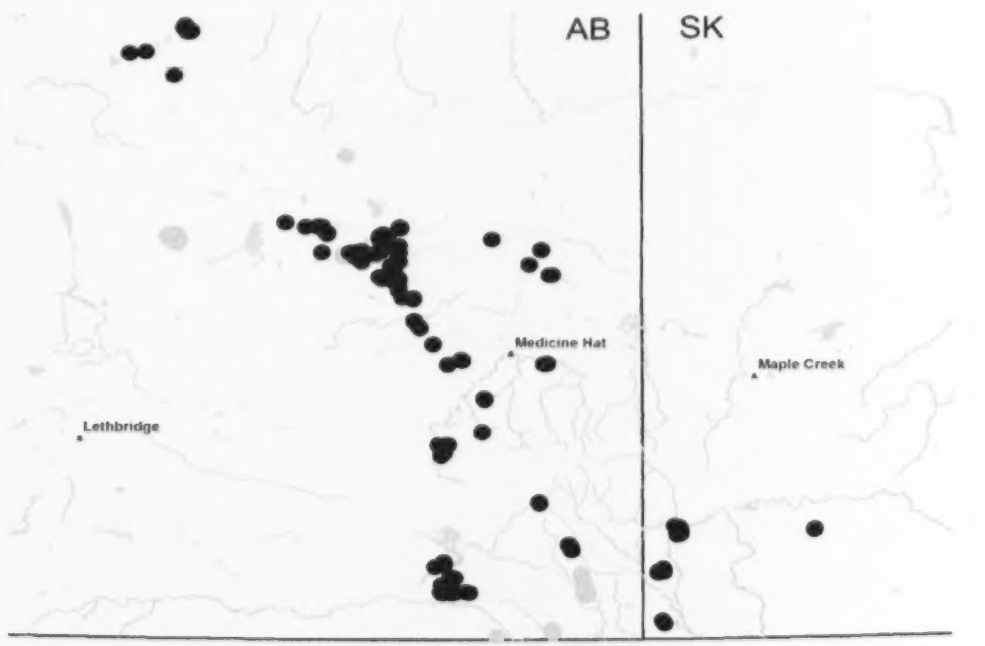

Figure 3. Range of Dwarf Woolly-heads, Prairie Population, in Alberta and Saskatchewan. [Note: black circles are extant subpopulations, light gray circles are historic subpopulations]

3.3. Needs of the Dwarf Woolly-heads

The Prairie Population of Dwarf Woolly-heads occurs in the Prairie Ecoregion where the area is characterized by very cold winters and short warm summers. The plants grow on the drying edge or drawdown areas of wetlands classified variously as "ponds" or "marshes" under the Canadian Wetland Classification System (National Wetlands

Working Group 1997) and as Class I (ephemeral) [7], II (temporary), and III (seasonal) wetlands under the Stewart & Kantrud (1971) classification scheme used most widely in the Prairie region (COSEWIC 2006, Morefield 2006). Occasionally plants have also been found along the drying edge or drawdown area of stream beds (Saskatchewan Conservation Data Centre [SK CDC], unpublished data 2015). These wetland areas contain shallow water for variable periods, usually at a peak in spring months after snowmelt or spring rains, but may be completely dry for part of the summer or fall, and in years of drought, may not contain any water. For the purposes of this management plan, suitable wetland habitat for Dwarf Woolly-heads will be collectively referred to as ephemeral wetlands. Soils where Dwarf Woolly-heads have been found are dry and often compacted, characterized as Solonetzic, alkaline or calcareous clay, or in some places, sandy soils (COSEWIC 2006, Morefield 2006, Environment Canada 2013c). The amount of suitable habitat for this species fluctuates greatly year-to-year depending on precipitation levels. Dwarf Woolly-heads can occupy this habitat because they can exploit the ephemerally flooded conditions better than perennial species in the same habitat. However, it is thought that Dwarf Woolly-heads grows better in areas of bare ground in the absence of competition from other plant species (Moore et al. 2001).

Limiting Factors

The most significant limiting factor for this species in the Prairie Population is its dependence on the magnitude and timing of precipitation events to create the wetlands required for completion of the life cycle. The life cycle of the Dwarf Woolly-heads is linked to the wet-dry cycle of these ephemeral wetlands, characterized by a wetting phase, aquatic or inundated phase, a water-logged terrestrial phase and a drought phase (Keeley and Zedler 1998). Dwarf-Woolly-heads seed germination begins during the wetting or aquatic phase, flowering during the transition between aquatic and water-logged phases, and fruiting during the dry phase (COSEWIC 2003, Douglas et al. 2006). Population sizes can fluctuate dramatically year-to-year because of this dependence.

Because it is an annual species, it is also reliant on aspects of its seed bank where the largest and most genetically diverse component of the population exists (Harper 1977, Silvertown and Charlesworth 2001). Future survival of subpopulations is dependent on the persistence of a viable seed bank and having conditions favourable for seed germination and seedling establishment to occasionally replenish the seed bank. This enables the species to be able to rebound after periods unsuitable for growth, or following disturbances (Cox and Austin 1990). Dwarf Woolly-heads is thought to have weak dispersal mechanisms, with dispersal of seeds likely reliant on wind or flooding for short distances and wildlife for longer distances (COSEWIC 2006). Seed dispersal between wetlands, both short and long distances, is important for colonization of new wetlands, and maintaining genetic integrity and diversity within existing subpopulations by introducing new genetic material. As this species is thought to be able to reproduce

[7] Ephemeral wetlands and vernal pools are often used interchangeably (Keeley and Zedler 1998); in this management plan, the term ephemeral wetlands will be used.

by self-pollination, inbreeding may also pose a potential risk, particularly in drought years when reproduction and recruitment is low (Environment Canada 2013c).

4. Threats

4.1. Threat Assessment

Table 2. Threat Classification Table for Dwarf Woolly-heads

Threat #	Threat description	Impact[c]	Scope[d]	Severity[e]	Timing[f]	Detailed threats/Comments
2	Agriculture & aquaculture	Low	Small	Serious	High	
2.1	Annual & perennial non-timber crops	Low	Small	Serious	High	Cultivation of wetlands
2.3	Livestock farming & ranching	Negligible	Unknown	Negligible	High	Trampling or pugging
3	Energy production & mining	Low	Restricted	Moderate	High	
3.1	Oil & gas drilling	Low	Restricted	Moderate	High	Oil or gas well pads
4	Transportation & service corridors	Medium	Large	Moderate	High	
4.1	Roads & railroads	Low	Small	Moderate	High	Oil or gas access roads, trails/off-road use, grid roads, highways through or adjacent to wetlands
4.2	Utility & service lines	Medium	Large	Moderate	High	Electrical transmission lines, oil and gas pipelines
6	Human intrusions & disturbance	Negligible	Negligible	Negligible	High	
6.2	War, civil unrest, & military exercises	Negligible	Negligible	Negligible	High	Military exercises
7	Natural system modifications	Low	Small	Extreme	High	
7.1	Fire & fire suppression	Unknown	Unknown	Unknown	Unknown	Fire suppression
7.2	Dams & water management/use	Low	Small	Extreme	High	Alteration to hydrological regimes
8	Invasive & other problematic species & genes	Low	Small	Moderate	High	
8.1	Invasive non-native/alien species	Low	Small	Moderate	High	Invasive alien plant species
9	Pollution	Low	Small	Extreme	High	
9.3	Agriculture & forestry effluents	Low	Small	Extreme	High	Non-specific herbicide use
11	Climate change & severe weather	Unknown	Pervasive	Unknown	Moderate	
11.2	Droughts	Unknown	Pervasive	Unknown	Moderate	Extended drought cycle

[c] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined

(e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[d] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[e] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[f] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2. Description of Threats

IUCN Threat 2. Agriculture & aquaculture

Threat 2.1 Annual & perennial non-timber crops

Historical conversion of prairie and ephemeral wetlands to cultivated cropland for forage and cereal crops likely contributed to the loss of Dwarf Woolly-head habitat and habitat fragmentation. It is possible that some of the subpopulations of Dwarf Woolly-heads are in prairie habitat not previously considered suitable for cultivation, but much of the surrounding habitat around known subpopulations is already cultivated, and with newer technologies, these remaining parcels may also be at risk in years where crop prices are high (Farm Credit Canada 2013, Wright and Wimberly 2013). There are a few subpopulations of Dwarf Woolly-heads located in ephemeral wetlands in cultivated fields; the practice of seeding into the edges of ephemeral wetlands in cultivated fields to increase the yield is common practice and anticipated to continue, or increase, particularly in drought years when the wetlands are drier. Some of these known subpopulations may no longer exist if this has already been done, although it is possible the plants may return in wet years if the seed bank is still viable. It is highly likely there are additional undetected subpopulations of Dwarf Woolly-heads in wetlands in cultivated fields, as this land is not included traditionally in rare plant surveys.

Threat 2.3 Livestock farming & ranching

Studies and observations on the impacts of grazing on ephemeral wetland systems have been somewhat inconclusive and contradictory. Trampling and pugging (depressions in wet soil created by hooves of cattle) have been reported as a threat for a few of the Dwarf Woolly-head subpopulations where grazing occurs (Alberta Conservation Information Management System [ACIMS], unpublished data 2015); however, botanists have also reported seeing Dwarf Wooly-heads colonizing the pugs (S. Vinge-Mazer, pers. comm. 2015). Impacts on plant species in ephemeral wetlands can vary significantly depending on the timing and intensity of grazing (Borgias 2004). Grazing can help suppress the growth of more competitive perennial vegetation, thereby increasing bare ground, to the advantage of ephemeral wetland plant species whose germination may be otherwise stifled. Research has also indicated that continuous grazing around vernal pools can increase native species richness and species diversity (Marty 2005). On the other hand, cattle grazing may increase the proliferation of invasive alien species in vernal pool ecosystems (see threat 8.1; Björk 2005). Hydrology of the vernal pools may be significantly altered by the removal of grazing, with ungrazed pools being inundated for less time, and drying out more times, than grazed pools (Marty 2004). Soil compaction was also higher in grazed pools. How these factors relate to Dwarf Woolly-heads recruitment and survival is unknown.

IUCN Threat 3. Energy production & mining

Threat 3.1. Oil & gas drilling

Well pads constructed over part, or all, of an ephemeral wetland can destroy habitat for Dwarf Woolly-heads or cause mortality to some or all of the subpopulation. Although oil and gas was reported as a threat for many of the known subpopulations, the severity of the oil and gas drilling would be dependent on the proximity to the wetland. Impacts of oil and gas drilling are expected to continue or increase in the future. Other impacts of oil and gas activities (pipelines, access roads, invasive alien species) are covered under the respective threat categories.

IUCN Threat 4. Transportation & service corridors

Threat 4.1. Roads & railroads

Creation of major roads (highways, grid roads) can directly cause habitat loss and fragmentation when they are constructed through, or across part of, ephemeral wetlands containing Dwarf Woolly-heads. Major roads can also affect hydrological flow into the wetlands, altering water levels, species composition, and permanency of wetlands (see threat 7.2 dams & water management/use). Road construction and/or maintenance can also result in mortality to individual plants or entire subpopulations, including the seed bank. Repeated vehicular use of minor roads (access roads for oil and gas, off-road trails through pastures) that go through or immediately beside ephemeral wetlands can also cause direct mortality of Dwarf Woolly-head plants.

The linear disturbances from roads also increase the potential for introduction and invasion by invasive alien species which may compete with Dwarf Woolly-heads (see threat 8.1). The linear disturbances and resultant habitat fragmentation may also impact animal movement, which may indirectly impact Dwarf Woolly-heads seed dispersal between suitable wetlands (Douglas et al. 2006). Oil or gas access roads going through or immediately adjacent to wetlands, construction or maintenance of grid and highways through or adjacent to wetlands, and repeated trail use through wetlands containing Dwarf Woolly-heads have all been reported as threats to this species (ACIMS, unpublished data; SK CDC, unpublished data). This threat is anticipated to continue or increase at known or newly discovered subpopulations.

Threat 4.2 Utility & service lines

Similar to roads, electrical transmission lines and oil or gas pipelines can result in direct habitat loss and fragmentation of ephemeral wetland habitat containing Dwarf Woolly-heads when the linear disturbance goes through them. Individual plants or entire subpopulations (including the seed bank) can be destroyed by the construction of pipelines. Pipeline ruptures will result in contamination of the soil, potentially rendering the habitat unsuitable for future growth. Of the known subpopulations, more than half

were reported to have either electrical transmission lines or pipelines running through or immediately adjacent to the wetlands containing Dwarf Woolly-heads, and approximately a third of these were reported to have destroyed all or part of the wetland. This type of disturbance is expected to continue, or increase at known or newly discovered subpopulations; often the same right-of-way is re-used for new transmission lines or pipelines, thereby expanding the width of the linear disturbance rather than creating a new one. This threat has been reported more frequently at Dwarf Woolly-head subpopulations and is anticipated to continue at the same rate as in the past, or increase.

Setbacks from occupied ephemeral wetlands may protect Dwarf Woolly-head subpopulations and habitat from direct disturbance from industrial activities like pipelines, transmission lines, and roads (see threat 4.1). Currently, setbacks in Alberta for activities like well sites and pipeline installations are 15 m from an ephemeral wetland (Class 1), and 45 m from a non-permanent temporary (Class 2) or seasonal (Class 3) wetlands, increasing to 100 m for Class 3 within the range of the Great Plains (*Anaxyrus cognatus*) or Plains Spadefoot (*Spea bombifrons*) toads (Government of Alberta 2013). Dwarf Woolly-heads are not currently listed under the Alberta Wildlife Act, but if it were added in the future, this setback would extend to 300 m for high impact activities and 30 m for low to medium impact activities (B. Downey, pers. comm. 2015). There are no specific setbacks from wetlands in Saskatchewan, but there are setbacks related to wetlands containing species at risk like Dwarf Woolly-heads, being 30 m for low to medium impact activities and 300 m for high impact activities (Saskatchewan Conservation Data Centre 2015).

IUCN Threat 6. Human intrusions & disturbance

Threat 6.1 War, civil unrest, & military exercises

One subpopulation has been reported within the CFB Suffield Range and Training Area. The training area is affected by frequent fires and disturbances from military activities (off-road vehicles, tanks, exploding ordinances, foot traffic, etc.). These activities may result in rutting up the wetland habitat, reducing vegetation cover, introducing alien invasive species (see threat 8.1), and altering species composition as well as directly damaging plants and the seed bed (McKernan 1984; Wilson 1988; Severinghaus 1990; but also see Warren et al. 2007).

IUCN Threat 7. Natural system modifications

Threat 7.1. Fire & fire suppression

Prairie plants evolved with ecological processes such as fire and grazing (Daubenmire 1968; White 1979; Lesica and Cooper 1999). Changes in land use practices since European settlement has resulted in reduction in the frequency and extent of prairie fires. It is unknown if, or how, this change has impacted wetlands and Dwarf Woolly-head subpopulations.

Threat 7.2. Dams & water management/use

Since Dwarf Woolly-heads rely on wet-dry cycles of wetlands to complete their life cycle, alterations to the hydrological regimes in wetlands they occupy can have large effects on subpopulations. Long-term alterations to hydrology around ephemeral wetlands can affect the frequency, magnitude, and duration of flooding (Leibowitz and Brooks 2008) which has large implications on organisms whose life cycles depend on these factors (Marty 2005). Drilling of wells, use of irrigation for agriculture, cultivation, drainage of wetlands or ditches, creation of dug-outs in wetlands, soil removal or fill, creation/maintenance of roads, pipelines, transmission lines, and any other diversion of surface or groundwater all have the potential to alter the hydrological regimes

IUCN Threat 8. Invasive & other problematic species & genes

Threat 8.1. Invasive non-native/alien species

During wetland drawdown or periods of drought, the habitat may become temporarily more suitable for alien invasive species to establish. Many ephemeral wetland plant specialists are more tolerable of inundated and dry, compacted soils, relative to other species (Bauder 2000, Moore et al. 2001). However, as conditions become less favourable for Dwarf Woolly-heads they become better suited to a suite of alien invasive species such as Smooth Brome (*Bromus inermis*), Quack Grass (*Elymus repens*), Kentucky Bluegrass (*Poa pratensis*), and Purple Loosestrife (*Lythrum salicaria*), particularly in wetlands surrounded by tame pasture or adjacent disturbances which have a higher potential for introduction of invasive alien species (roads, pipelines, oil and gas wells, transmission lines, etc.). Invasive alien plants can pose a direct threat through competition because they can displace native species, decrease species diversity or richness through their superior competitive ability and/or result in overall negative effects on ecosystem functioning (Wilson 1989; Wilson and Belcher 1989; Reader et al. 1994; Christian and Wilson 1999; Bakker and Wilson 2001; Butler and Cogan 2004; Henderson 2005; Henderson and Naeth 2005). The threat of invasive alien species is expected to continue and increase in future years.

IUCN Threat 9. Pollution

Threat 9.3. Agriculture & forestry effluents

Indiscriminate use of herbicides intended to control broad-leaved plant species will likely kill individuals or subpopulations of Dwarf Woolly-heads (COSEWIC 2006). This activity is more of a threat in wetlands surrounded by cultivated fields where use of herbicides is prevalent and overspray, run-off, or drift may occur, as well as along linear disturbances (pipelines, transmission lines, roads) where herbicides are being used to control invasive alien species.

IUCN Threat 11. Climate change & severe weather

Threat 11.2. Droughts

Prolonged drought periods which would not allow germination of Dwarf Woolly-head seeds, thereby preventing replacement of the seed bank or completion of its life cycle, would likely be a threat. Severity of this threat would depend on the longevity of seeds in the seed bank; this is currently unknown. Finally climate warming is a threat because of the realized and projected effects on temperature and precipitation levels across the Canadian prairies (IPCC 2007). Climate change, anticipated to result in increased temperatures in winter, will decrease snow packs and the amount of spring runoff important in forming vernal pools (IPCC 2007). Increased spring and summer temperatures may also contribute to increased evaporation and soil drying (IPCC 2007). Combined, these effects will decrease the length of the wetting and inundation periods, and will likely decrease the number and frequency of favourable years that best support subpopulations of Dwarf Woolly-heads.

5. Management Objective

The management objective for the Prairie Population of Dwarf Woolly-heads is to maintain the currently known extant subpopulations of Dwarf Woolly-heads in Alberta and Saskatchewan, as well as any additional subpopulations newly located or rediscovered in the future.

Since the subpopulation sizes, trends, and area of occupancy in the Prairie Population are not well known (COSEWIC 2006) and variations in annual precipitation cause large fluctuations in population size year to year, it is not feasible to establish a quantitative management objective at this time.

6. Broad Strategies and Conservation Measures

6.1. Actions Already Completed or Currently Underway

In 2011, Saskatchewan Ministry of Environment (Saskatchewan Conservation Data Centre) and again in 2014, along with Nature Saskatchewan, conducted targeted surveys for Dwarf Woolly-heads, revisiting known and historic subpopulations as well as searching new suitable habitat. In 2004-2006, and 2013, Environment Canada conducted targeted Dwarf Woolly-heads surveys on suitable habitat on federal lands (National Wildlife Areas, Agriculture and Agri-Food Canada Community Pastures). The only known targeted survey in Alberta occurred in 1996 (COSEWIC 2006, ACIMS, unpublished data 2015).

Dwarf Woolly-heads may be added in the future to the multi-species action plan for the "South of Divide" planning region in southwestern Saskatchewan. This plan includes critical habitat identification for endangered and threatened species, but also best management practices and stewardship proposals for all species at risk occurring in the South of the Divide area.

6.2. Broad Strategies

In order to achieve the management objective, conservation measures will be organized under four broad strategies:

- Inventory and monitoring
- Research as part of an adaptive management framework
- Communication, collaboration and engagement
- Habitat Assessment, management and conservation

6.3. Conservation Measures

Table 3. Conservation Measures and Implementation Schedule

Conservation Measures	Priority[g]	Threats[h] or Concern Addressed	Timeline
Broad Strategy: **Inventory and monitoring**			
Using consistent survey guidelines (e.g. Henderson 2010), continue surveys in suitable habitat (including ephemeral wetlands in cultivated or tame fields) throughout the known range to locate new subpopulations or relocate unconfirmed or historic subpopulations.	Medium	Measure progress towards attaining the management objective	Begin in 2018 and continue annually for at least 5 years
Encourage provincial governments to include requirements for surveys for plant species at risk to occur in ephemeral wetlands in agricultural land (i.e., tame pasture and cultivated).	Medium	Knowledge gaps, 2.1, 7.2, 9.3	2019
Using consistent monitoring guidelines, implement a monitoring plan across the known range examining population dynamics and habitat trends/conditions.	Medium	Response to all threats; measure progress towards attaining the management objective	By 2019, then triennially or as determined by the plan
Broad Strategy: Research as part of an adaptive management framework			
Conduct research to develop a better understanding of the species ecology and needs (e.g., seed bank viability, recruitment and survival, dispersal mechanisms and success, genetic exchange)	Low	Knowledge gaps	2018-2021
Conduct research on anticipated climate change effects on ephemeral wetlands in prairie ecosystems.	Low	11.2	2019 onwards
Conduct research on threat impacts (e.g. fire or fire suppression, grazing, sensitivity periods to disturbance, threshold levels of developments) and management practices on subpopulations and habitat quality.	Medium	All threats	2019-2022
Identify areas where ephemeral wetland habitat is at highest risk of degradation or loss due to current or future threats.	High	All threats	2019
Apply research findings to developing or amending beneficial management practices for ephemeral wetlands and Dwarf Woolly-heads habitat.	High	All threats	2020

Investigate effectiveness of beneficial management practices, and adjust or adapt as needed to benefit the species.	Medium	All threats	2021 onwards
Encourage and support research projects where Dwarf Woolly-heads is a target response variable	Low-Medium	Knowledge gaps; all threats	Initiated within 3 years of 2018
Broad Strategy: Communication, Collaboration and Engagement			
Determine effective methods for engaging landowners and land managers in removing barriers to implementing conservation measures with respect to ephemeral wetland habitat.	Medium	2.1, 2.3, 7.2, 8.1, 9.3	2018-2019
Engage landowners, land managers, and industry in implementing conservation measures and beneficial management practices.	High	2.1, 2.3, 3.1, 4.1, 4.2, 6.2, 7.1, 7.2, 8.1, 9.3	2019 onwards
Develop or adapt communication materials for the importance and conservation of ephemeral wetlands in agricultural lands, including use of herbicides and seeding into wetland margins.	Medium	2.1, 7.2, 9.3	2018
Broad Strategy: Habitat Assessment, Management and Conservation			
Engage landowners and land managers, through conservation or stewardship agreements, to preserve the integrity of ephemeral wetland habitats and margins, and limit new developments around occupied ephemeral wetlands.	High	2.1, 2.3, 3.1, 4.1, 4.2, 6.2, 7.1, 7.2, 8.1, 9.3	2018 onwards
Target stewardship and conservation measures at areas identified as being at highest risk for future loss or degradation, and promote/encourage continued stewardship of areas already being managed or conserved.	High	2.1, 2.3, 3.1, 4.1, 4.2, 6.2, 7.1, 7.2, 8.1, 9.3	Ongoing
Encourage provincial government (SK) to establish wetland set-back guidelines for new developments around wetlands on public land. Encourage provincial government (AB) to consider adding Dwarf Woolly-heads to their Wildlife Act so it is afforded additional setback protection from developments.	Medium	2.1, 3.1, 4.1, 4.2, 7.1, 9.3	2018-2019

[g] "Priority" reflects the degree to which the measure contributes directly to the conservation of the species or is an essential precursor to a measure that contributes to the conservation of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the management objective for the species. Medium priority measures may have a less immediate or less direct influence on reaching the management objectives, but are still important for management of the population. Low priority conservation measures will likely have an indirect or gradual influence on reaching the management objectives, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

[h] Threat numbers refer to the IUCN-CMP classification (see Table 2 for full threat names).

6.4. Narrative to Support Conservation Measures and Implementation Schedule

Broad Strategy: Inventory and monitoring

There have been only a few targeted surveys for Dwarf Woolly-heads in the Prairies and these either assessed presence/absence or provided a rough estimate of population size with no measure of error included. These targeted surveys for Dwarf Woolly-heads were primarily on native prairie. Many occurrences or subpopulations have been reported by consultants during rare plant surveys for environmental impact assessments on pipelines, well sites, roads or transmission lines. Surveys related to potential developments are supposed to occur on all suitable habitat, but often ephemeral wetlands in cultivated fields or tame fields are missed or ignored. As a result of these factors, Dwarf Woolly-heads surveys likely represent a small, biased sample of potentially occupied habitats in the Prairies and the characteristics and relative distribution of threats in occupied compared to unoccupied habitat are largely unknown. This constrains the ability to make informed management recommendations that minimize risks to the species and meet the needs of decision makers and land users. Inventories in recent years have started using standardized survey methodology (e.g., Henderson 2010), and therefore the quality and confidence in data being collected has been improved. Continuance of standardized inventories in suitable habitat, including cultivated and tame fields, in good growing years, across the known range of the Prairie population, is warranted. Additionally, data surrounding population dynamics, habitat trends/conditions, and threats is lacking for all subpopulations. A long-term monitoring plan, likely applied to a subset of subpopulations across the range, to measure and monitor these variables to obtain data useful for future COSEWIC status assessments is also needed.

Broad Strategy: Research as part of an adaptive management framework

Knowledge gaps, limiting factors and threats identified for Dwarf Woolly-heads may be addressed through research and adaptive habitat management. Knowledge on aspects of species ecology, such as dispersal, seed bank dynamics, genetics, and specific germination requirements, may help determine the adaptability of this species to future climate change or habitat restoration, and if there are periods of higher sensitivity to disturbance. Research on threat impacts, including climate change, in addition to species ecology and habitat needs, will result in more targeted beneficial management plans and mitigation recommendations for agricultural, industrial and transportation sectors impacting habitat of Dwarf Woolly-heads. Once beneficial management plans are implemented, an adaptive approach should be applied through monitoring of the subpopulations and habitat, and evaluating the management actions, making changes where needed to benefit the species and ephemeral wetland habitat.

Broad Strategy: Communication, collaboration and engagement

The role of ephemeral wetlands in an ecosystem is often not considered important; as a result, they are often sprayed over with pesticides, seeded over in cropland or tame fields, or drained. Increasing education and awareness of the role of ephemeral wetlands, and addressing the barriers to implementing conservation measures is recommended through various communications, including stewardship site visits. Beneficial management practices and other conservation measures should be implemented after barriers have been addressed.

Broad Strategy: Habitat Assessment, Management and Conservation

Conservation of habitat containing dwarf woolly-heads through voluntary measures like stewardship agreements, beneficial management practices and setback distances from wetland edges for disturbances will be key to reducing threats and mitigating against further decline.

7. Measuring Progress

Success in implementing this management plan will be measured against the following performance indicator:

- The currently known subpopulations of the Dwarf Woolly-heads in Alberta and Saskatchewan (Prairie Population), as well as any additional subpopulations newly located or rediscovered in the future, are maintained or increased by 2023.

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Appendix A: Summary of Dwarf Woolly-head Subpopulations in Canada

Subpopulation Name [EO_ID][i,j]	First Observed	Last Observed	Recent Survey Estimate [Year]	Highest Estimate [Year]	Threats[k]	COSEWIC Population "Locality"[l]
Saskatchewan						
[11270] [m]	unknown	2014	100 plants [unknown]	100 plants [unknown]	None recorded	
West of Govenlock [16316] [n]	1999	2014	17 plants and 8 clusters [2014]	17 plants and 8 clusters [2014]	None recorded	
West Olga [16315] [n]	1997	2014	500-800 plants [1997]	500-800 plants [1997]	Oil & gas drilling	
Northwest of Consul [3052] [m]	1979	2014	1848 plants [2012]	3800 plants [1997]	None recorded	Prairie 28, Prairie 29, Prairie 30
Alberta						
West Trefoil 1 [16041]	2006	2006	52 plants [2006]	52 plants [2006]	Roads, oil or gas pipeline in vicinity, invasive alien species (smooth brome)	
West Trefoil 2 [16042]	2006	2006	No Estimate	No Estimate	Cultivation, oil or gas pipeline in vicinity, non-specific herbicide use	
West Trefoil 2 [16043]	2006	2006	No Estimate	No Estimate	Cultivation, oil or gas pipeline in vicinity, non-specific herbicide use	
West Trefoil 3 [16044]	2006	2006	No Estimate	No Estimate	Cultivation, oil or gas pipeline adjacent, non-specific herbicide use	
Southeast Gahern 1 [16524]	2007	2007	No Estimate	No Estimate	Road (township road)	
Southeast Gahern 2 [16525]	2007	2007	No Estimate	No Estimate	Road (access road)	
Southeast Gahern 3 [16526]	2007	2007	No Estimate	No Estimate	Trampling (cattle)	
Southeast Gahern 4 [16527]	2007	2007	No Estimate	No Estimate	None recorded	

Subpopulation Name [EO_ID][i,j]	First Observed	Last Observed	Recent Survey Estimate [Year]	Highest Estimate [Year]	Threats[k]	COSEWIC Population "Locality"[l]
Southeast Gahern 5 [16528]	2007	2007	No Estimate	No Estimate	None recorded	
Southeast Gahern 6 [18395]	2008	2008	32 plants [2008]	32 plants [2008]	Oil & gas drilling (well pad)	
Southeast Gahern 7 [22680]	2008	2008	1563 plants [2008]	1563 plants [2008]	Oil & gas drilling (well pad), oil or gas pipeline	
Canadian Forces Base Suffield [17195]	2007	2007	40 plants [2007]	40 plants [2007]	Invasive alien species, military training, Gas wells	
Drowning Ford 1 [22137]	2010	2010	>300 plants [2010]	>300 plants [2010]	Gas wells, roads (access roads, off-road trails)	
Drowning Ford 2 [17783]	2007	2007	1405 plants [2007]	1405 plants [2007]	Roads (access road), oil or gas pipeline	
Drowning Ford 3 [7365][n]	1997	1997	>2748 plants [1997]	>2748 plants [1997]	Oil or gas pipeline	Prairie 5
Bantry 1 [22407]	2010	2010	1000 plants [2010]	1000 plants [2010]	Electrical transmission line	
Bantry 2 [20924]	2009	2009	1000-5000 plants [2009]	1000-5000 plants [2009]	Oil or gas pipeline, oil or gas drilling (well pad adjacent), road (access road), haying (perennial non-timber crops),	
Bantry 3 [22408]	2010	2010	1000 plants [2010]	1000 plants [2010]	Electrical transmission line	
Bantry 3 [22411]	2010	2010	5035 plants [2010]	5035 plants [2010]	Electrical transmission line, oil or gas drilling (well pad adjacent), road (highway adjacent)	
Bantry 3 [22412]	2010	2010	2034 plants [2010]	2034 plants [2010]	Electrical transmission line, road (highway adjacent)	
West Suffield [24293][n]	date unknown	date unknown	No Estimate	No Estimate	None recorded	
West Suffield 1 [22259]	2010	2010	No Estimate	No Estimate	Gas drilling	
West Suffield 1 [22421]	2010	2010	1050 plants [2010]	1050 plants [2010]	Electrical transmission line	

Subpopulation Name [EO_ID][i,j]	First Observed	Last Observed	Recent Survey Estimate [Year]	Highest Estimate [Year]	Threats[k]	COSEWIC Population "Locality"[l]
West Suffield 1 [7367][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (10% of wetland habitat lost)	
West Suffield 1 [7379][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (30m of wetland drainage channel lost)	
West Suffield 1 [7381][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (10% of wetland habitat lost)	
West Suffield 1 [7382][n]	1996	1996	No Estimate	No Estimate	None recorded	
West Suffield 2 [22258][n]	2007	2010	>1500 plants [2010]	>1500 plants [2010]	Gas drilling	
West Suffield 2 [7366][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (10-15% of wetland habitat lost)	
West Suffield 2 [7377][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (30 m of wetland drainage channel lost)	
West Suffield 3 [7378][n]	1996	1996	No Estimate	No Estimate	None recorded	
West Suffield 4 [23086]	2008	2008	>12200 plants [2008]	>12200 plants [2008]	Oil or gas drilling (well pad), oil or gas pipeline (adjacent), road (access road adjacent), pugging (cattle)	
West Suffield 4 [23088][n]	2008	2010	11073 plants [2010]	11073 plants [2010]	Electrical transmission line, oil or gas drilling (well pad adjacent)	
East Maleb 1 [22422]	2010	2010	1000 plants [2010]	1000 plants [2010]	Electrical transmission line, roads (grid road adjacent)	
East Maleb 2 [22426]	2010	2010	8 plants [2010]	8 plants [2010]	Electrical transmission line, roads (grid road adjacent)	
East Maleb 3 [22430]	2010	2010	2050 plants [2010]	2050 plants [2010]	Electrical transmission line	
Southwest Woolchester [22431]	2010	2010	No Estimate	No Estimate	Electrical transmission line	
Medicine Hat 1 [22432]	2010	2010	No Estimate	No Estimate	Electrical transmission line, gravel extraction pit (100 m away)	

Subpopulation Name [EO_ID][i,j]	First Observed	Last Observed	Recent Survey Estimate [Year]	Highest Estimate [Year]	Threats[k]	COSEWIC Population "Locality"[l]
Medicine Hat 2 [7368][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (10% of wetland habitat lost)	
Medicine Hat 2 [7369][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (20% of wetland habitat lost)	
Medicine Hat 2 [7370][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline	
Medicine Hat 2 [7380][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (20% of wetland habitat lost)	
Medicine Hat 2 [7385][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline	
Northeast Bain [22664][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (20-25% of wetlands lost)	
Fitzgerald [7371][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (25% of wetland habitat lost)	
Southwest Eagle Butte [7372][n]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline (50% of wetland habitat lost)	
West Suffield [24292][o]	1927	1927	No Estimate	No Estimate	None recorded	Prairie 14
Southwest Cressday 1 [22662][o,p]	1996	1996	No Estimate	No Estimate	Oil or gas pipeline	
Southwest Cressday 2 [7376][o]	1979	1979	3000 plants [1979]	3000 plants [1979]	None recorded	Prairie 16
[7361][o]	1989	1989	No Estimate	No Estimate	None recorded	Prairie 1
[7362][o]	1990	1990	>50 plants [1990]	>50 plants [1990]	None recorded	Prairie 2
Lonesome Lake [7363][o]	1989	1989	No Estimate	No Estimate	None recorded	Prairie 3
Lost River [7364][o]	1985	1985	No Estimate	No Estimate	None recorded	Prairie 4

[i] EO_ID refers to the element occurrence identification number, as assigned by the provincial Conservation Data Centre to indicate a distinct element occurrence based on NatureServe's habitat-based plant element occurrence delimitation guidance (NatureServe 2015a). For the purposes of this management plan, we are considering an element occurrence to be analogous to a subpopulation (IUCN 2001).

[j] Values and occurrences in the table are those known to Environment Canada, as submitted by the Conservation Data Centres, as of Nov. 2014 in Alberta and Feb. 2015 in Saskatchewan. Sources: ACIMS (pers. comm. and unpubl. data 2014), SK CDC (pers. comm. and unpubl. data 2015),

COSEWIC (2006), Environment Canada (unpubl. data). Note that most estimates or counts are frequently from only a few occurrences at each subpopulation, and therefore values presented here should not be interpreted as an estimate for the entire subpopulation. In addition, the data show that often counts or estimates are taken at different occurrences in subsequent years, or new occurrences are found in subsequent visits and those are added on to the estimates for a subpopulation. Therefore, it is difficult to compare estimates among years. Estimates or counts also vary among years depending on factors discussed in Sec 3.2 such as yearly fluctuations in annuals and use of different census techniques.

[k] The threat of dams & water management/use (alteration to hydrological regimes) should also be considered as a potential threat wherever roads, pipelines, transmission lines, oil & gas drilling, cultivation, and drainage of wetlands is occurring.

[l] The location data for the subpopulations (localities) listed in the COSEWIC 2006 status update report as Prairie 31-41 are not available (Fairbairns, pers. comm. 2013; SK CDC, pers. comm. 2013). Subpopulations reported as Prairie 26 and 27 have no record in the 2014 data from Alberta (ACIMS, unpublished data). As such, these subpopulations aren't included in this summary table, nor are able to be included in the management objective until the data is located. Population localities listed in the COSEWIC 2006 status update report as Prairie 6-13, 15, 17-25 cannot be matched with CDC element occurrence records from 1996 as the information provided in COSEWIC is too vague to distinguish them; as a result, they are not listed here.

[m] There are some historic occurrences within this subpopulation. The historic occurrences are not being considered as part of the management objective at this time.

[n] There are occurrences within this subpopulation considered somewhat inaccurate as they have been reported to the quarter section level only and not the actual coordinate location within the quarter section. This subpopulation will still be included as part of the management objective, however.

[o] This entire subpopulation is considered historic and is not being included as part of the management objective at this time.

[p] This subpopulation is possibly extirpated and is not being included as part of the management objective at this time.

Appendix B: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[8]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[9] (FSDS) goals and targets.

Conservation planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of management plans may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the management plan itself, but are also summarized below in this statement.

The most significant effect that the conservation of Dwarf Woolly-heads will have on other species will be in the protection of their ephemeral wetland habitats. Several other plant and animal species use ephemeral wetlands during some part of their life cycle or daily activities, even if they are not confined to them (Silveira 1998, Calhoun and deMaynadier 2008). In terms of use by species listed under the federal *Species at Risk Act*, the Long-billed Curlew (*Numenius americanus*, special concern) and Mountain Plover (*Charadrius montanus*, endangered) have been observed feeding on the shoreline and mudflats of ephemeral wetlands or on the adjacent alkali grassland (Silveria 1998). Short-eared Owl (*Asio flammeus*, special concern) have been observed in grasslands adjacent ephemeral wetlands (Silveira 1998). Common Nighthawk may nest in the dry wetland bed or adjacent alkali grassland (Silvera 1998), while the ephemeral wetlands provide an important source of insects for food (Environment Canada 2015). Ferruginous Hawk (*Buteo regalis,* threatened) have also been observed using the ephemeral wetland shoreline (Silveira 1998). The Great Plains Toad (*Anaxyrus cognatus,* special concern) and Northern Leopard Frog (*Lithobates pipiens*, special concern) rely on ephemeral wetlands for breeding (Environment Canada 2013a, Environment Canada 2013b). Therefore, it is likely the conservation of habitat for Dwarf Woolly-heads will benefit other species that use ephemeral wetlands where the species co-occur.

Any management activities, conservation measures or beneficial management plans should strive to benefit as many species as possible, and the ecological risks of any action must be considered before undertaking them to reduce any potential negative

[8] www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[9] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

effects on other species and their habitats. Efforts should be coordinated with other recovery teams, and organizations working on ephemeral wetlands or in prairie habitat surrounding Dwarf Woolly-head subpopulations. This will ensure the most efficient use of resources, prevent duplication of effort, conflicts with research, and minimize negative impacts to species at risk.